in size, when the telescope is used for viewing the sun. He finds that, with a small eyehole, such as is necessary in the Gregorian telescope, the whole aperture of the object-glass may be used without endangering the dark shade.* The eyehole should be placed where an image of the object-glass is formed by the eyepiece, or, what is the same thing, where the axes of the different pencils cross each other. The aperture of the hole should not be less than the image formed by the object-glass, and need not be larger. Mr. Reade finds, from actual experience, that this position and limitation of the eyehole greatly improves the definition of the telescope for all celestial objects.

Extract of a Letter from Captain Hardy to Dr. Lee.

" I wish to call your attention to four remarkable spots, all belonging to the same mass, which are now (May 8) passing across the sun's disc. They entered his upper limb on the 29th or 30th of April, a little to the eastward of his north pole. They proceeded southward in nearly a straight line, and the principal spot crossed his equator about May 4. They are now approaching the lower limb, and are, at $3^h 30^m$ this day, two-thirds of the way down. The form of this mass is singular, and in many respects different from anything I have seen before."

A series of drawings of the sun has been forwarded from Poona by Capt. Jacob. Capt. Jacob, we are informed, has been appointed to succeed the late Mr. Taylor at the Observatory of Madras.†

Lunar Theory.

It will be remembered that in the investigation of the correction of the Elements of the Moon's Orbit required by the Greenwich Lunar Observations, the Astronomer Royal pointed out the following term as not recognised by theory but of undoubted existence :

Inequality in the Moon's Latitude $= +2''\cdot17 \cos u$;

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* Mr. Reade is of opinion that the thermal rays, in a refracting telescope, do not follow the same course as the illuminating rays; that they are considerably diffused at the eyehole, and that a large portion is stopped there when the eyehole is small. Have any experiments been made to ascertain the path of thermal rays when transmitted through an achromatic object-glass and through different kinds of glass ?

† The Editor would suggest to the observers of solar spots the necessity of being very careful and specific in their *measures.* No safe conclusion can be drawn from general impressions or vague descriptions. The situations of the spots should be referred distinctly and by measure to the limbs or centre.

A guess has been hazarded that the spots are not attached to the sun, but are rather of the nature of planets or comets revolving round him. It need scarcely be stated here that there is no probability in favour of this supposition, which was exploded by Galileo on satisfactory grounds. Besides his reasons, the spots cannot be *free* bodies *near* the sun, their motions are too slow; while the absence of parallax proves that the spots cannot be near the earth, the only position which they *could* occupy to satisfy the slow motion. Every intelligible account of the solar spots seems to confirm Sir William Herschel's hypothesis, that they are variable openings in the luminous atmosphere of the sun.

where u is the moon's true longitude. (See *Monthly Notices*, 1848, June 9, vol. viii., No. 8, page 187.)

We have the gratification now to state that this term has been shewn to be a legitimate deduction from accurate theory. Our Associate, Professor Hansen, of Gotha, in a letter to the Astronomer Royal, has given the following account of it : — It is known by elementary investigations in physical astronomy that, supposing the plane of the earth's orbit to be invariable, the mean inclination of the moon's orbit to the earth's orbit is constant. Laplace made a very important addition to this theory in shewing that, though the plane of the earth's orbit is undergoing a change from the action of the planets, steadily progressing in one direction, yet the mean inclination of the moon's orbit to the variable plane of the earth's orbit will be sensibly constant. Now, Professor Hansen has introduced a slight modification in this theory. He finds that the position of the moon's orbit will be more correctly represented by the following conception. "Take the plane of the earth's orbit in the position in which it was about three years ago ; let the nodes of this plane revolve backwards on the present ecliptic through 90°, without change of inclination, the plane so found is the plane to which the uniformity of inclination of the moon's orbit is to be referred." The effect of this, omitting terms which are inseparably mingled with other terms, is to produce in the moon's latitude the inequality,—

$$= + 1''\cdot 38 \text{ cos moon's longitude} ;$$

that found from the observations,—

$$= + 2''\cdot 17 \text{ cos moon's longitude}.$$

The same train of investigation has given a term in the moon's longitude,—

$$= - 0''\cdot 50 \text{ cos longitude of node} ;$$

while that deduced from the observations, and hitherto unexplained, is,—

$$= - 0''\cdot 97 \text{ cos longitude of node}.$$

The small differences which remain are in all probability due to errors of observation."

After the termination of the sitting, the Astronomer Royal exhibited a specimen which he had received from Mr. May, illustrative of the construction of the pivots of the new transit circle for the Royal Observatory, of which the massive parts are now progressing under the superintendence of Mr. May. By long meditation on the causes of uncertainty in instrumental observations, and more particularly by consideration of the state of the Cape Mural Circle, in which (after its return to England), it was found that its steel axis-collar had been merely fastened on by soft solder, and could easily be turned by hand, the Astronomer Royal had been led to the determination that, in every new instrument constructed under his direction, the pivots should be cast in the same flow of metal with the parts which they immediately support. The advantages which cast-iron presents for the construction of large instru-

ments (from the facility with which it is cast, and its small thermal expansion when in the manufactured state), had long made him desirous of using that material. And Mr. May had pointed out to him that these objects might be obtained, giving at the same time extreme hardness to the surface of the pivot, by the process called *chilling*, in which the pivot, or other part to be hardened, is cast in a mould of iron at a certain temperature, other parts (in the same flow of metal) being cast in sand in the usual manner. The chilled surface is too hard to be turned on the lathe by a tool in the ordinary way, but it may be turned with most perfect accuracy, and most complete command of its surface, by using, instead of an ordinary tool, a leaden wheel charged with emery, which is turned with great rapidity, and is at the same time moved backwards and forwards in the direction of the axis of the pivot: the pivot being turned slowly to it as in the ordinary lathe-turning.

The specimen forwarded by Mr. May was a part of a perforated cylinder, in all respects similar to the instrument-pivots, which had been chilled in casting, had been turned and ground in the manner above described, and had been broken, so as to shew the depth to which the chilled structure penetrates.

It has already been mentioned that the splendid heliometer by Repsold (the largest and most perfect instrument, we believe, now existing of its class) has been received at the Radcliffe Observatory quite safe. The Trustees have directed that it should be mounted with corresponding magnificence, and the building is now nearly completed. A handsome round stone tower, in advance of the east wing of the observatory, is carried up high enough to give the instrument a clear view to the north horizon; the south is open, and the only direction in which the view is confined is to the northwest, where the central tower of the observatory intercepts an unimportant part of the sky. We are confident that in Mr. Johnson's hands the instrument will do credit to the talents of the artist, and justify the discerning liberality of the Radcliffe Trustees.

Books, papers, &c. for Professor Schumacher may be forwarded to Mr. Dent, who will transmit them to Altona as occasions offer.

Mr. Beaumont wishes to dispose of a transit telescope, $2\frac{3}{4}$ inches' aperture, of the best construction, with its Y's, near collimating mark and lens, morocco observing chair, and copper shutters, for 80*l*. The original cost was above 200*l*.

Also of a clock by Molyneux.

ERRATA.

In Mr. Airy's Circular of May 21, in the epoch *for* " March," *read* " May."

P. 139, Captain Shea *presented* his book of drawings.
P. 143, line 28, *for* " L + ," *read* " L — "
,, ,, *for* " L' + ," *read* " L' — "

but it is safer to work out each case according to its nature, and not to follow a formula.